Integrating online deliberation into ecosystem service valuation

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Statement of authors' contributions

Haojie Chen, the lead author, proposed the research, drafted the paper, and made most of the revisions to address reviewers' comments. Robert Costanza, Ida Kubiszewski, Matthew R. Sloggy, Luhua Wu, and Tong Zhang refined the paper and assisted with the revisions. All authors read and approved the paper.

Highlights

- Preferences for ecosystem services can be stated via online deliberation.
- Deliberation promotes information sharing and mutual learning.
- Online deliberation may be more flexible and confidential than in-person deliberation.
- Effective deliberation should be inclusive, engaging, and open.
- Deliberation media (e.g., typing, video meetings) may affect deliberation effectiveness.

Abstract

Stated preference valuation of ecosystem services involves participants answering hypothetical questions to express preferences. Participants tend to respond to the hypothetical questions separately, without any deliberation (the process of considering and discussing within a group). However, a relatively recent development in deliberation research involves asking participants to state preferences via deliberation. Deliberation is historically conducted in-person but can now also be done online. This paper covers the strengths and limitations of integrating online deliberation into stated preference valuation, including: (1) comparison between stated preference valuation with and without deliberation, (2) comparison between in-person and online deliberation, and (3) comparison between online deliberation media, such as typing, video meetings, and voice calls. Conducting deliberation can broaden participants' understanding of the target ecosystem services and others' preferences. However, this requires

participants' willingness to deliberate and increases time investment. Online deliberation has lower costs and travel restrictions and higher time efficiency and confidentiality of personal information than in-person deliberation. However, people with low abilities or willingness to use online media are disadvantaged. Differences in the online deliberation media may reduce or improve the inclusiveness, engagement, and openness of deliberations in ways that affect valuation results. We also provide suggestions for selecting deliberation media and mitigating deliberation bias derived from the choice of deliberation media. Further research should explore how to improve time efficiency and affordability of online deliberation, how to promote inclusiveness, engagement, and openness of online deliberation, and how different deliberation media affect deliberation quality and valuation results.

Keywords: ecosystem service assessment, non-marketable valuation, deliberation quality, valuation methods, focus group, online communication

1. Introduction

Many environmental issues are the negative impacts from socioeconomic development that may ignore or underestimate the importance of life-supporting ecosystems and their benefits to humans (Chen 2020). The benefits humans obtain from ecological processes, functions, and characteristics are termed ecosystem services (ESs) (Costanza et al. 1997; Millennium Ecosystem Assessment 2005; Costanza et al. 2017). Many ESs are not traded in the market or included in Gross Domestic Product hence their values are relatively invisible compared to marketable socioeconomic benefits measured in monetary units (Costanza et al. 2014; Chen 2021; United Nations SEEA-EA 2021). Therefore, ES valuation in monetary units is a crucial step in integrating the wide variety of ESs into socioeconomic decision-making process and measure socioeconomic development more comprehensively.

Since the publication of Costanza et al. (1997) and the Millennium Ecosystem Assessment (2005), ES valuation studies have been growing. Valuation of non-marketable ESs is difficult or impossible for revealed-preference approaches, such as the market price approach or travel cost approach, and might instead require stated preference approaches that elicit preferences for the ESs through asking participants hypothetical questions and analysing their answers (Pascual et al. 2010; Bishop et al. 2017; Whittington et al. 2017; United Nations SEEA-EA 2021). Stated preference approaches are especially common for assessing non-use values attributed to existence of an object, bequest or altruistic purposes (Johnston et al. 2017).

Typically, participants respond to hypothetical questions of stated preference valuation separately (Farber et al. 2002; Kenter et al. 2011; Chen et al. 2023). The key word here is "separately". However, a relatively recent development in deliberation research involves asking participants to state preferences via deliberation (the process of considering and discussing within a group of participants) (Kenter et al. 2016c; Costanza 2020; Lliso et al. 2020). Table 1 shows the basic steps of inferring preferences via deliberation. The idea of combining deliberation with valuation of environmental goods already occurred in the 1990s (c.f. Brown et al. (1995)). Deliberation-based ES valuation in practice began in the early 2000s (Bunse et al. 2015) and became increasingly used after 2010, especially in the context of the UK National Ecosystem Assessment (Bartkowski and Lienhoop 2019). Note that, preference-eliciting surveys may also involve focus groups, which are "conversations in a small group of people on a specific topic with the aim of getting to know the group's opinion on the research topic" (Kelemen et al. 2013, p. 321). Focus group conversations correspond to deliberation, if they are conducted to share, discuss, and reshape preferences between participants. However, focus group conservations are not viewed as deliberation, if they are only conducted to pre-test questionnaires.

Table 1: Example of the basic steps of inferring preferences via deliberation

Steps	Descriptions
(1) Convening	Convening participants together, either physically or virtually, and dividing participants into smaller deliberation groups
(2) Questioning	Providing participants with preference-eliciting questions and letting participants consider the questions separately;
(3) Preference sharing	Participants sharing their preferences (answers to the questions) with each other in their groups and explaining their rationale of expressing a certain preference;
(4) Discussion	Participants debating/discussing with each other about which preference (e.g., the price of an entrance ticket to a natural site) reflects collective or public wellbeing the best;
(5) Preference restating	Participants expressing preferences after deliberation separately, or reach a consensus (e.g., through voting for the best accepted value of an ES from the perspective of collective and public wellbeing)

Stated preference valuation with and without deliberation reflect different rationale for value elicitation (Raymond et al. 2014), as some researchers are questioning whether aggregation of separately measured individual preferences can represent the values of ESs, especially collective and public ESs (see further discussion and references in Section 2). While traditionally in-person deliberation may be restricted by costs and physical distance, development of communication technologies has enabled online deliberation, which was of particular interest during the COVID-19 pandemic and will likely be used to a greater degree for ES valuation moving forward. Investigation is needed to assess whether integration of online deliberation into stated preference valuation will lead to more considered, representative, and credible preferences, compared to stated preference valuation without deliberation or with in-person deliberation.

Despite the potential use of online deliberation in future ES valuation studies, this topic has been insufficiently explored and discussed (Chen et al. 2022; Andrade et al. 2023). This paper comments on the strengths and limitations of integrating online deliberation into stated preference approaches, including: (1) comparison between stated preference approaches with and without deliberation, (2) comparison between in-person and online deliberation, and (3) comparison between online deliberation media (typing, voice calls, video meetings). Note that, this paper does not consider stated preference approaches with deliberation either superior to, or more advanced than, the approaches without deliberation. Nor does it consider a certain medium of deliberation better than the other media in all situations. Instead, this paper aims to assist ES researchers, managers, and decision makers with different research conditions and purposes in understanding (1) under what circumstances a stated preference approach with or without deliberation may be more suitable to value ESs, especially non-marketable ESs, (2) whether online or in-person deliberation may result in a higher quality of deliberation outcomes in a given context, and (3) which online deliberation medium may be the most effective and adopted in different research contexts. Deliberation quality and effectiveness will be explained in Section 3. To further address these three questions and improve potential applicability of online deliberation in the context in ES valuation, we suggest what can be studied in future research.

2. Comparison between stated preference valuation with and without deliberation

Table 2 shows a subset of concerns about stated preference approaches without deliberation, as well as arguments of deliberation's benefits for addressing the concerns. While there are also counterarguments of many of the benefits of deliberation, it is widely recognised that deliberation can enable information sharing, public debate and reasoning, and mutual learning among participants in ways that valuation without deliberation cannot (see references in Table 2). This strength broadens participants' understanding of ESs, others' preferences, and collective benefits, and is especially important for valuing common ESs held by communities and public ESs that are non-excludable and non-rival. Deliberation also affects participants' preferences. For example, Kenter et al. (2011) and Wang et al. (2017) found that deliberation increased participants' recognition of ESs' importance, and so increased participants' willingness to pay for the ES. However, Kenter et al. (2016b), Kenter (2016), and Chen (2022) found declines in individual willingness to pay after deliberation, as deliberation may integrate consideration of substitutes of ESs and lead to more critical expressions of payment (e.g., how the money could otherwise be spent).

The major limitation of deliberation is the difficulty in convening people to participate in deliberation or keeping people in deliberation long enough to achieve desired outcomes, as deliberation is more time-consuming and costly than simply filling out a questionnaire (Costanza 2020; Chen et al. 2022). In particular, it is difficult to design a series of deliberative processes that can convene a sufficiently representative sample of a large-scale study area, and so study populations might be limited (Bunse et al. 2015). Without satisfactory remunerations, those who are willing to join deliberation are typically a small fraction of those who are willing to simply fill out a questionnaire. For example, only 196 people were willing to join a deliberation out of 1264 willing to fill out a questionnaire in a study by Chen (2022) and 96 out of 1683 in a study by Kenter et al. (2016b). When deliberation involves only a limited number of participants, the results of preferences expressed via deliberation may be biased as only those individuals with the time and interest will participate (Turner et al. 2010; Saarikoski and Mustajoki 2021). In this case, researchers are also concerned about heterogeneity in the results (Wanek et al. 2023). Therefore, integration of deliberation into stated preference valuation may reduce statistical representativeness of valuation results. However, sample selection corrections (Heckman 1979) may be used to correct for bias that arises from the insufficient sample selection in deliberation. Another concern is whether participants can express upfront preferences through deliberation. However, as online communication tools are more widely available, the following section discusses if online communication tools bring opportunities to overcome the limitations of in-person deliberation.

Table 2: Arguments and counterarguments of deliberation's benefits for addressing the concerns about stated preference approaches

Concerns about stated preference approaches without deliberation	Arguments of deliberation's benefits for addressing the concerns	Counterarguments of deliberation's benefits for addressing the concerns
Preferences stated by separate individuals may not truly reflect the values of many ESs that contribute to both individual and collective wellbeing, as individuals' understanding of ESs may be limited and self-centred without considering diverse ESs' values and human-nature relationships (Lo and Spash 2013; Kenter 2016; Orchard-Webb et al. 2016; Kenter et al. 2016a; Schaafsma et al. 2018; Stoeckl et al. 2018; Costanza 2020)	Deliberation allows information sharing and public debate and reasoning, benefits mutual learning, enables participants to consider a wider range of issues related to ESs, and facilitates participants to express preferences that reflect what is desirable for a community or society (Schwartz 1999; Wilson and Howarth 2002; Kenter et al. 2015; Vargas et al. 2016; Kenter et al. 2016b; Mavrommati et al. 2020; Saarikoski and Mustajoki 2021)	The counterargument that focus group discussions can substitute for deliberation is not always applicable. When stated preference approaches incorporate focus group discussions solely to pretest questionnaires without sharing participants' preferences or eliciting values, the approaches are not deliberation-based valuation.
Individuals stating preferences separately in monetary units also favours people with higher incomes who are not as economically constrained as poor people (Spash 2007), potentially ignoring fairness concerns (Costanza and Folke 1997; Spash 2007; Costanza et al. 2017).	As mentioned above, deliberation facilitates participants to express preferences that reflect what is desirable for a community or society	While willingness to pay may be constrained by income, willingness to accept may overcome the income constraints for expressing preferences (Whittington et al. 2017).
Participants may misunderstand the research questions and purposes and lack sufficient opportunity to consider and explain their preferences (Kenter et al. 2011; Jiang et al. 2023).	Deliberation may elicit more considered and accurate preferences, because it (1) gives participants more opportunities to consider and explain their preferences, and (2) allows researchers to explain research to and interact with participants. This increases participants' trust in researchers and reduces participants' misunderstanding of, and resistance to, research (Szabó 2011; Lliso et al. 2020; Saarikoski and Mustajoki 2021; Jiang et al. 2023).	Whether participants understand questionnaires correctly can be addressed through good survey design and pre-test with either sperate individuals or focus groups (Powe et al. 2005; Zhao et al. 2013; Johnston et al. 2017). Even if a stated preference survey does not integrate deliberation, researcher can also give participants sufficient time to consider questions, ask participants to explain their reasoning (e.g., through filling an open-ended question or interview), and allow participants to contact researchers for clarification and explanations.

Ignorance of the fact that preferences can change over time in many cases (Kenter et al. 2015)	Deliberation can affect and change preferences (such as references in the row below).	Experts who conduct stated preference valuation without deliberation do not view preferences as valid forever but temporarily. This fact about preferences applies to both stated preference approaches with and without deliberation.
Preferences are expressed divergently (see references in the right column).	Deliberation may lead to consensus building and more converged preferences (Kenter et al. 2011; Kenter et al. 2015; Lienhoop et al. 2015; Orchard-Webb et al. 2016)	If multiple views of ESs' values are needed, why is a consensus needed? If a consensus means a choice selected by the largest proportion of participants, the consensus can also be reflected by separately filled questionnaires without deliberation.

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3. Online deliberation as an alternative to in-person deliberation

The main difference between multiple deliberation media (e.g., being in-person or online) is not about the rationale or process for eliciting valuation, but rather about the quality or effectiveness of deliberation. Deliberation effectiveness ultimately affects deliberation outcomes (Monnoyer–Smith and Wojcik 2012; Wang et al. 2017), and we will compare different deliberation media based on the conditions for effective deliberation. These conditions include (1) inclusiveness: a wide range of representatives are involved, (2) engagement: this means researchers should facilitate as many participants as possible to fully exchange their opinions and interact with each other, and (3) openness: diverse values, beliefs, and opinions are expressed in a transparent manner and respected (Cohen 1989; Kenter et al. 2011; Lo and Spash 2013; Orchard-Webb et al. 2016; Vargas et al. 2016; Kenter et al. 2016c; Stoeckl et al. 2018; Grainger and Stoeckl 2019; Varumo et al. 2020). These conditions are important, as inclusiveness affects statistical representativeness of preferences expressed, whereas engagement and openness both affect how in-depth deliberation is conducted to promote sufficient information sharing, debating, and mutual learning, which changes participants' preferences through affecting their understanding of ESs, others' preferences, and collective benefits.

Both in-person and online deliberation have means to improve inclusiveness and have issues that might reduce inclusiveness. A major advantage of online deliberation is its low costs and flexibility, including removal of physical constraints (e.g., geographic distance and access), reduction of travel and meeting expenses, and higher time efficiency (e.g., no need to spend time traveling to a meeting place) compared with in-person deliberation (Cindio et al. 2010; Strandberg and Grönlund 2018). Online deliberation is more feasible for convening participants compared with in-person deliberation during a pandemic lockdown and in situations where participants are distributed in different regions. However, a precondition of online deliberation is having access to the internet as well as sufficient skills to use online deliberation platforms. Exclusion of people without internet access or IT-literacy may lead to a bias in both data collection and the understanding of the general population's preferences (Hartz-Karp and Sullivan 2014; Chen 2022).

Both online and in-person deliberation can hinder and incentivize engagement. During both online and in-person deliberation, facilitators can try to balance power asymmetries between participants by giving voice to marginalized groups (e.g., through proactively asking marginalized people questions). Compared with online deliberation, some people prefer in-person deliberation because face-to-face situations are easier for them to understand others' emotions and thus incentivize them to be more interactive and comfortable when communicating to others (Varumo et al. 2020). However, online deliberation has a higher-level of confidentiality of personal information than in-person deliberation. While in-person deliberation may also request participants not to disclose any personal information, such as jobs and income, personal identifies are not only reflected by what people say but also how people look (e.g., what they wear, how confident they look) (Stromer-Galley 2002; Halpern and Gibbs 2013). Thus, those who dislike disclosure of any personal information may be more willing to express opinions and interact online. Hiding personal identities may also shift the focus of participants from "who is speaking" to "what is being said" (Stromer-Galley 2002; Strandberg and Berg 2015). This weakens the concern about the perceived power or social status of other participants that may affect a participant's confidence to speak during deliberation (Wilson and Hoehn 2006; Talpin and Wojcik 2012). However, "computer-savvy" participants may still dominate discussions in online deliberation (Dahlberg 2001; Smith et al. 2009), potentially limiting engagement of the other participants. In other words, discrepancies

in information technology skills and media habits affect participants' abilities or willingness to engage (Albrecht 2006; Smith et al. 2009).
It is unclear if in-person or online deliberation tends to exhibit greater transparency, an element of openness. However, online deliberation that can hide more personal details may reduce respect, another element of openness. Hiding personal details may not necessarily impact deliberation results negatively (Strandberg and Berg 2015), but it implies that participants can be less accountable for their words and hence increases the risk of aggressive and disrespectful behaviour (e.g., using abusive language to resist opposing opinions) (Wright and Street 2007; Halpern and Gibbs 2013; Friess and Eilders 2015; Chen 2022).

4. Comparison between online deliberation media: typing, video meetings, voice meetings, and hybrid online meeting

Potential media for online deliberation include (1) typing, such as writing and commenting on a post, online forums, and group chatting via text messages, (2) video meetings where participants chat verbally with camera on, (3) voice calls where participants chat verbally without camera on, and (4) hybrid online meetings where multiple media, including typing, video meetings, and/or voice calls, are used synchronously by different participants (e.g. in the same meeting, some participants keep camera on, whereas the others do not; some participants chat verbally, whereas the others choose written communication through typing). These media have different features that affect inclusiveness, engagement, and openness of deliberation, as described below.
First, we compare inclusiveness. Some people are embarrassed to speak or show their faces to a group of strangers (Halpern and Gibbs 2013; Chen 2022), while the others may enjoy verbal chats or prefer cameras on. There is a lack of evidence regarding how this bias might affect participation and therefore preference estimates. Hybrid meetings can integrate more types of people and might be more inclusive than voice calls and video meetings. However, like video meetings and voice calls, hybrid meetings are synchronous and hence exclude participants who cannot find a commonly available time for deliberation. This limitation can be overcome by asynchronous typing (Varumo et al. 2020).
Which medium has the highest level of engagement is ambiguous and understudied. Voice calls, video meetings, and hybrid meetings that involve immediate verbal chats may allow for quicker interaction and build a sense of collective action (Varumo et al. 2020), whereas typing, especially asynchronous typing, gives participants more opportunities to consider opinions carefully and organise language (Wright and Street 2007; Price 2009). Showing one's face may make some participants uncomfortable and reduces their engagement, whereas hiding faces makes it more challenging for participants to include non-verbal cues, interpret emotions, and signal one's willingness to say something, which can also reduce engagement.
The level of openness achieved by each medium is also ambiguous. Transparency means those not involved should be able to see what has happened in deliberation (Stern 2005). In this sense, asynchronous typing is more transparent than synchronous media, because it allows participants to view a written chat record regardless of when they join deliberation. However, as typing hides more personal information than synchronous media, typing means lower social cost and higher risk of disrespectful behaviours. Which synchronous media is the most open is unclear. Thus, some future research is suggested in Section 5.

Different online deliberation media can potentially introduce differing levels of bias into deliberation results, owing to their distinct communication styles, levels of anonymity, technology proficiency requirements, and the composition of their user base (e.g., participants with certain characteristics may be more inclined to a certain medium). To mitigate bias

stemming from the choice of deliberation media, researchers may (1) collect demographical information of participants to help understand their preferences for specific media and to identify potential sources of bias associated with their individual characteristics, (2) provide technical assistance or pre-research trainings to participants to help them be familiar and comfortable with the chosen medium (Andrade et al. 2023), (3) implement a random assignment approach (Johnston et al. 2017) to distribute participants across various media, minimizing potential bias due to self-selection, (4) conduct a post-study survey of participants' feedback on whether a chosen medium influences their engagement in deliberation and other aspects of deliberation quality, and (5) be transparent about potential bias due to media selection in research (Chen et al. 2022).

5. Conclusion and suggestions

Deliberation promotes information sharing, debating, and mutual learning among participants. This broadens participants' understanding of ESs, others' preferences, and collective benefits. However, deliberation is costly, potentially limiting the number of available participants. Typically, those willing to engage deliberation for a stated preference valuation survey constitute only a subset of individuals who would readily complete a valuation questionnaire. Consequently, results derived from deliberation-based stated preference valuation studies tend to exhibit lower statistical representativeness than studies without deliberation. In addition, the population benefiting from an ES might differ from the population that can join deliberation of a stated preference valuation study. To mitigate bias arising from this sample selection issue, researchers can employ sample selection correction methods (Heckman 1979).

Online deliberation can be a feasible and lower-cost alternative to in-person deliberation, especially when travel and in-person meetings are restricted. Online deliberation might make individuals feel more secure sharing their opinions because their personal information is better protected. However, reduced disclosure of personal information can also promote bad behaviour, potentially disrupting the openness of deliberation. Online deliberation may also exclude or reduce the engagement of people with limited abilities or willingness to use online media. Unlike video meetings, voice calls, and hybrid meetings, typing offers participants greater time flexibility, confidentiality of personal information, and opportunities to consider opinions. However, some people prefer immediate verbal chats and using cameras. Hybrid meetings are more inclusive than voice calls and video meetings but still exclude those who cannot join synchronous deliberation. Accordingly, there is no one-fit-all conclusion regarding which deliberation medium is the most inclusive, engaging, or open. To address bias in deliberation results derived from the selection of online media, several strategies can be adopted, including analysis of demographical information, technical assistance, pre-research training, random assignment of participants, survey of participants' feedback, and disclosure of the bias, as discussed previously.

Additional research and practical experience are needed to determine which medium leads to the best deliberation quality under various contexts and how various approaches affect valuation results. For example, do different media change expression of preferences to different extents? Research on this topic is difficult because (1) it is challenging to conduct quantitative comparison of deliberation media's impacts on deliberation quality and valuation results, and (2) selection of deliberation media (Figure 1) may be more dependent on research purposes, resource availability (e.g., funding, time allowance), travel and meeting conditions, and people's demands, rather than the deliberation effectiveness (inclusiveness, engagement, and openness) of the media. Research on this topic would require all participants to be able and willing to use all media for comparison. Obviously, such research would be difficult to implement, but it would yield useful results for future designs of stated preference studies. More feasible research can focus on improving the quality of online deliberation, including

how to undertake deliberations in a time-efficient and financially affordable manner for researchers and participants, how to convene larger, more representative, and inclusive groups of participants, and how to promote openness and participant engagement in online deliberation.

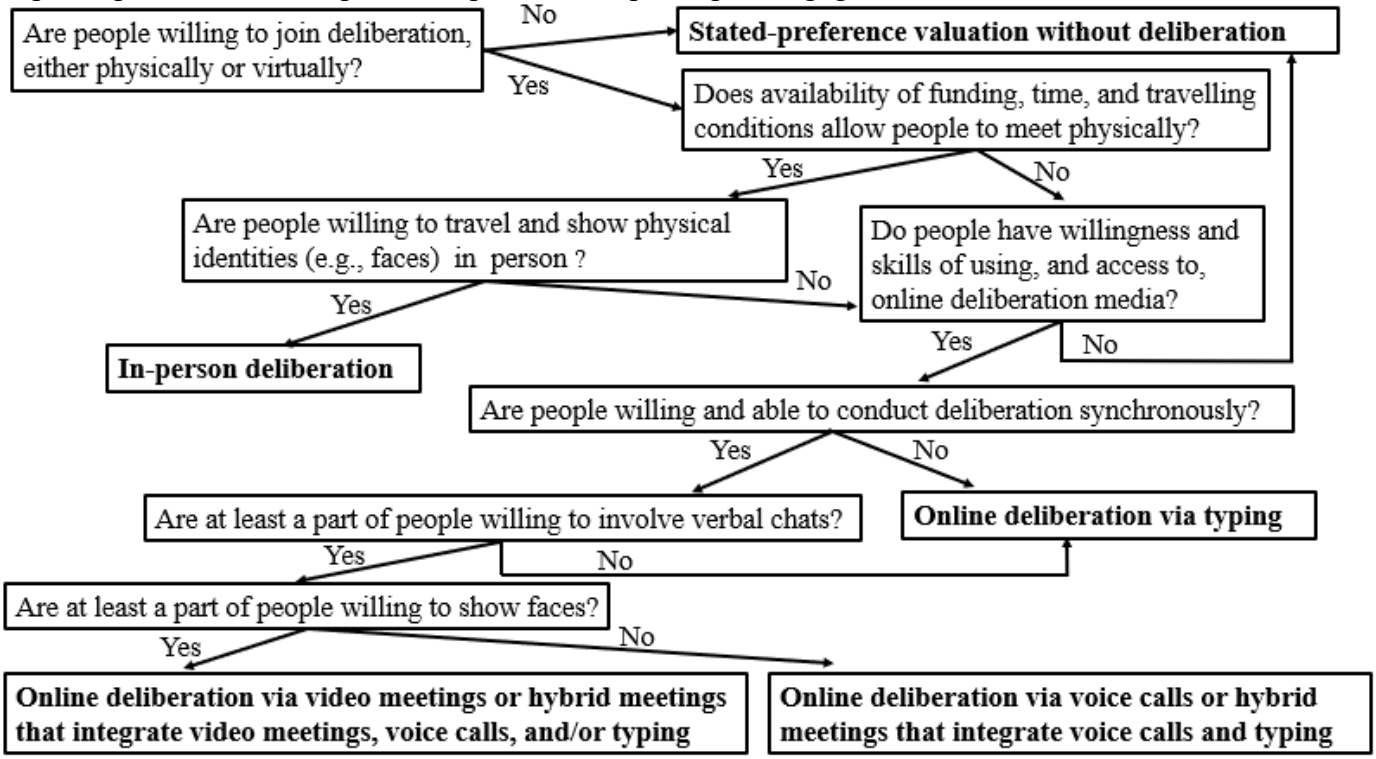

Figure 1: Guidance on selecting deliberation media (source: created by the authors)

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